Prepared for:

Ministry of Transportation

Sea to Sky Corridor Modal Diversion Study

Draft Report

June 2002

Prepared by:

TSI Consultants

318 – 4190 Lougheed Hwy
Burnaby, BC V5C 6A8 Canada

Tel: 604-293-2882
Fax: 604-293-2892

Website: www.tsigroup.ca

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1. Introduction

1.1 Background

In January 2002, TSi Consultants completed the Sea-to-Sky Corridor Travel Demand Study[1] for a multi-agency client that included the Ministry of Transportation (MoT). The study provided an estimate of the current inter-city travel demand in the Sea-to-Sky corridor and forecast future demand for a range of multi-modal options. It was concluded that enhanced bus service and a passenger ferry alternative showed some potential, but would not divert significant demand from the highway. Enhanced rail service between North Vancouver and Whistler was not deemed to be a viable alternative for servicing long-term demand in the corridor. This study assumed status quo transportation demand management (TDM) measures and no highway tolling within the study area.

1.2 Study Objective

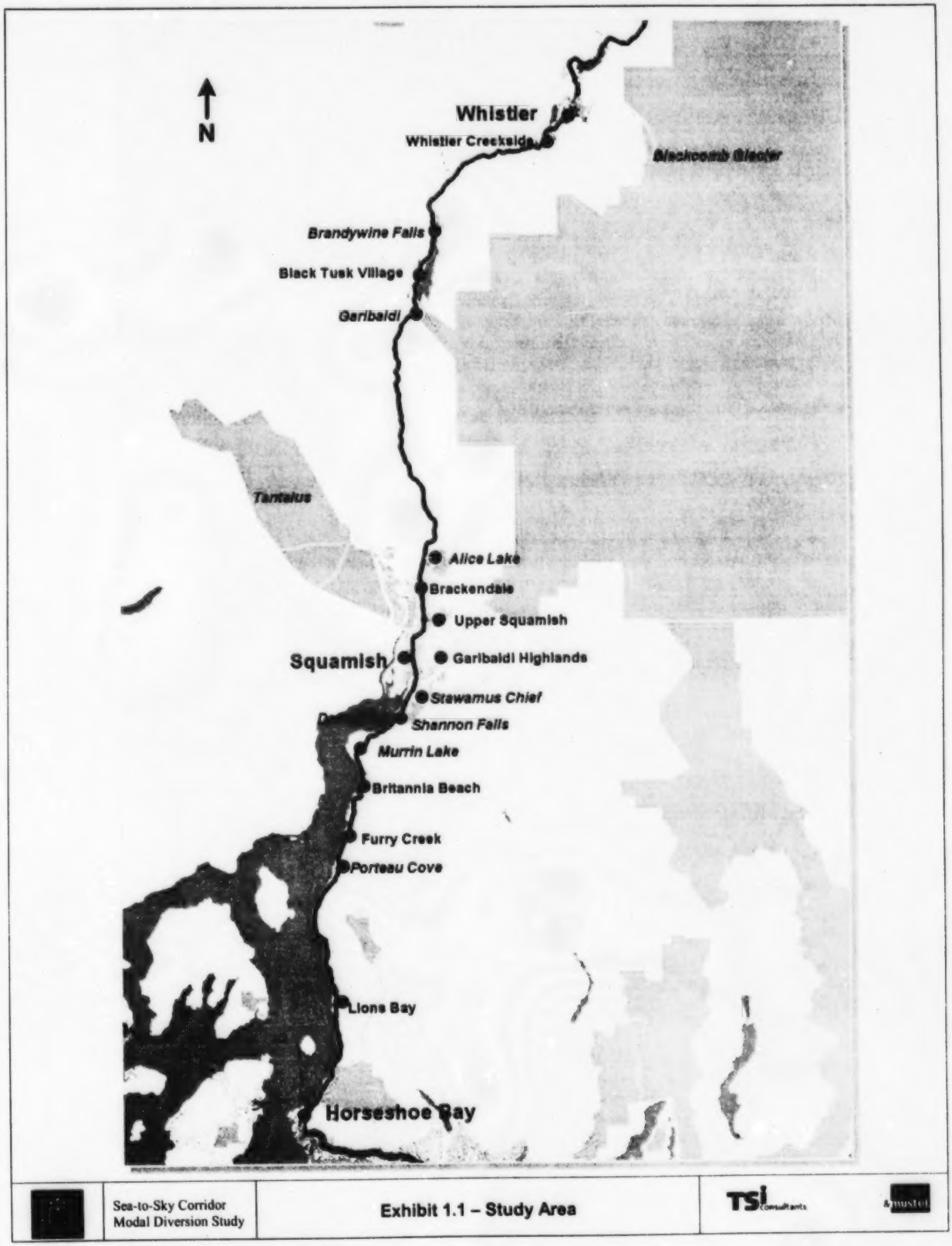
The objective of this study is to estimate the proportion of Sea-to-Sky auto travellers that would divert to alternate modes with the introduction of highway tolls on an upgraded highway. Two toll concepts are examined to determine the potential modal diversions. The toll concepts are tested against three modal alternatives including a scheduled coach bus service, high-speed rail and a passenger-only ferry/rail service between Vancouver, Squamish and Whistler. These options have been identified in previous studies and provide different levels of service (e.g., travel times, fares, etc.) and also range dramatically in terms of capital and operating costs.

A key component of this study is a stated preference survey with Sea-to-Sky corridor and GVRD residents, which provides the basis for determining modal diversion rates under two proposed toll concepts. It is important to note that non-resident travellers were not surveyed for this study, but are addressed using modal diversion information from other studies. Note that non-residents represents approximately 17 percent of the inter-city corridor demand (based on a previous study by TSi Consultants) and are relatively insensitive to highway tolls (as the toll represents a small percentage of their overall vacation/travel cost).

[1] TSi Consultants et. al., Sea-to-Sky Corridor Travel Demand Study, prepared for BC Ministry of Transportation, BC Rail, Resort Municipality of Whistler, TransLink, Transport Canada, January 2002.

The Sea-to-Sky corridor is identified in this study as the urban and rural areas adjacent to Highway 99 North between Horseshoe Bay and Whistler, B.C. **Exhibit 1.1** highlights the communities and activity centres along the corridor.

This report is organized in five sections. **Section 1** provides an introduction to the study. **Section 2** provides a summary of the previous Sea-to-Sky Corridor Travel Demand Study conducted by TSi Consultants and presents the toll concepts and modal options examined for this study. **Section 3** describes the design and implementation of the stated preference survey. **Section 4** presents the results from the modal diversion analysis. Conclusions are presented in **Section 5**.



Sea-to-Sky Corridor
Modal Diversion Study

Exhibit 1.1 – Study Area

TSI Consultants

Hunter

2. Sea-to-Sky Corridor Options

As this study represents a follow-up to the Sea-to-Sky Corridor Travel Demand Study, it is useful to provide a brief overview of the earlier study for context. This section also includes a description of the toll concepts and modal options that were evaluated for the current study.

2.1 Summary of the Previous Travel Demand Study

The Sea-to-Sky Corridor Travel Demand Study provided an estimate of the current inter-city travel demand in the Sea to Sky corridor and forecast future demand for the following multi-modal options:

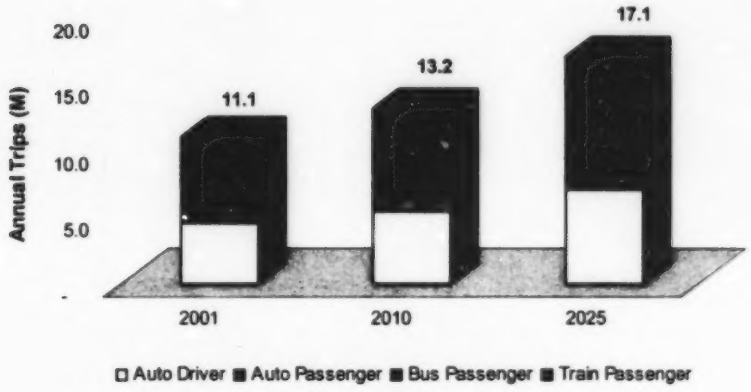
- **Highway Emphasis** included the four laning of Highway 99 North between Horseshoe Bay and Squamish and safety and urban improvements for the entire corridor to Whistler.
- **Medium Rail Investment** featured increased rolling stock and service frequency for the passenger rail between Lonsdale Quay and Whistler (three northbound and three southbound trips daily). Train passenger fares between North Vancouver and Squamish would be $25 one-way and $50 one-way to Whistler.
- **Maximum Rail Investment** would result in the reduction of line-haul travel time by as much as 25 minutes while offering identical passenger service frequencies as Option 2. Train passenger fares between North Vancouver and Squamish would be $35 one-way and $70 one-way to Whistler.
- **Passenger-Only Ferry/Bus** included a new passenger-only ferry service between Central Waterfront and Squamish, and bus connection up to Whistler (four northbound and four southbound trips daily). Ferry/Bus passenger fares between Vancouver and Squamish would be $25 one-way and $35 one-way to Whistler.

Two marketing research studies were completed to assess current demand levels and consumer interest in the proposed options. The first survey involved telephone interviews with 900 residents of the Sea-to-Sky corridor and Lower Mainland. An on-site survey at Whistler was also completed with 200 non-residents (e.g., people who live outside the corridor and Lower Mainland) to determine their travel characteristics and responsiveness to the corridor options. Additionally, a survey of bus companies operating in the corridor was conducted in order to estimate inter-city bus movements and ridership.

Based on this research, the current inter-city corridor demand was estimated at 4.5 million vehicles trips and approximately 11 million person trips per year. Residents of the corridor and Lower Mainland represent approximately 83 percent of the total travel demand. The remaining 17 percent of travel is made by non-residents (e.g. Rest of B.C., Canada and International). Auto demand (drivers and passengers) accounts for 93 percent of total inter-city demand. Bus and rail passengers account for six percent and less than one percent of travel demand, respectively.

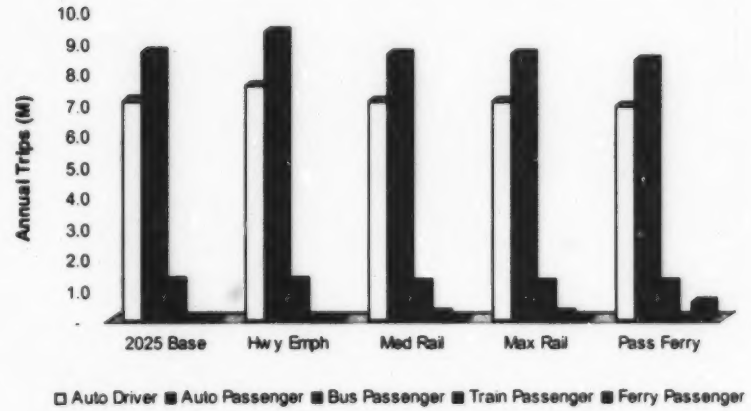
Demand was forecast to increase to 7 million vehicle trips and 17 million person trips by 2025 under status quo conditions as shown in **Exhibit 2.1**.

Exhibit 2.1 - STS Baseline Travel Demand Forecasts



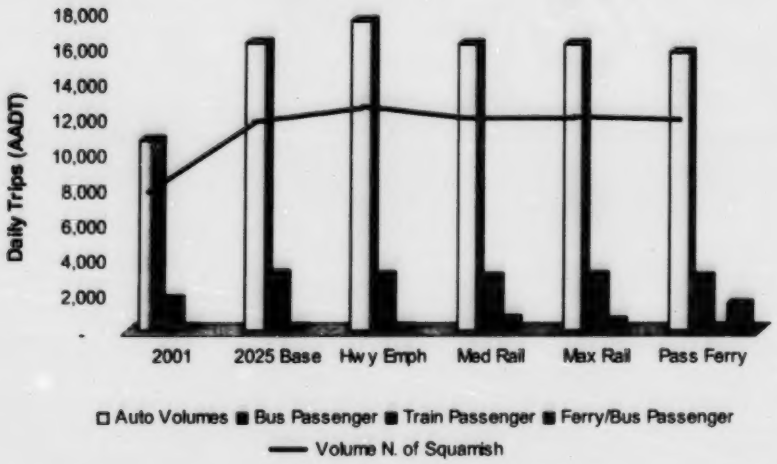
Travel forecasts were also developed for the four options in 2010 and 2025. **Exhibit 2.2** provides a summary of the 2025 travel demand estimates by mode. The Highway Emphasis option produced slightly higher travel demand than the other options (18 million vs. 17 million annual trips), as people were more likely to use the corridor if it were upgraded. The multi-modal options appeared to have a minimal impact on auto demand. The medium and maximum rail options generated approximately 0.2 million annual trips, while the passenger-only ferry/bus option generated 0.55 million annual trips. Although a new bus concept was not evaluated for this study, existing scheduled and charter bus services continued to show strong potential (approximately 1.2 million annual trips in 2025).

Exhibit 2.2 – 2025 Annual Corridor Option Travel Demand



These forecasts were developed using a detailed travel demand model that included travel estimates by market segment, mode and origin and destination for each time horizon and modal option. As a result, mid-corridor daily traffic volumes (AADT) could be estimated as shown in **Exhibit 2.3**. The bars show the two-way AADT (auto volumes) and bus, rail and ferry passenger volumes in 2025, midway between Vancouver and Squamish (e.g. near Furry Creek). Under base conditions, the AADT was forecast to increase from 10,800 in 2001 to 16,300 in 2025. For the highway emphasis option, daily auto volumes were forecast to increase to 17,500. The red line shows the 2025 auto volume forecasts midway between Squamish and Whistler.

Exhibit 2.3 – 2025 Daily Two-Way Travel Volumes



This study concluded that the enhanced bus service and the passenger-only ferry alternatives showed some potential, but would not divert significant demand from Highway 99 North.

2.2 Toll Concepts and Modal Options

The previous study estimated the corridor travel demand by mode based on no highway tolling within the study area. The current study was designed to examine the impact that tolls would have on diversion to alternative modes. For the purpose of this study, two toll concepts developed by MoT were examined for the Sea-to-Sky corridor as follows:

- **Toll 1** $5 Vancouver – Squamish, Squamish – Whistler
  $10 Vancouver – Whistler
  $100 Monthly pass for frequent users with unlimited usage
- **Toll 2** $8 Vancouver – Squamish, Squamish – Whistler
  $16 Vancouver – Whistler
  $100 Monthly pass for frequent users with unlimited usage

Each toll concept was evaluated in conjunction with highway upgrades and the introduction of new multi-modal services as defined below:

- **Option 1 - Expanded Toll Highway** with four lanes between Horseshoe Bay and Squamish and three lanes between Squamish and Whistler.
- **Option 2 - Expanded Toll Highway with Scheduled Bus Service** from Downtown Vancouver to Whistler with stops in Squamish and along the route.
- **Option 3 - Expanded Toll Highway with High Speed Rail** between Vancouver Waterfront station, Squamish and Whistler.
- **Option 4 - Expanded Toll Highway with Passenger Ferry/Train** combination. A passenger-only ferry would operate between Downtown Vancouver and Squamish, and train service between Squamish and Whistler.

Average travel cost and travel time assumptions for each option are summarized in **Exhibit 2.4** with further detail on the options presented below.

Exhibit 2.4 – Future Options Travel Time and Travel Cost Estimates

	Option 1 Toll Hwy	Option 2 Toll Hwy with Bus	Option 3 Toll Hwy with Rail	Option 4 Toll Hwy with Ferry
A. Average Out-of-Pocket Costs[1]				
Vancouver - Squamish				
Auto				
Maintenance & Fuel	$8	$8	$8	$8
Toll Fare (Toll1/Toll2)	$5/$8	$5/$8	$5/$8	$5/$8
Monthly Toll Pass	$100	$100	$100	$100
Modal Alternative				
Fare	N/A	$10	$35	$25
Monthly Fare Pass	N/A	$100	$350	$250
Vancouver - Whistler				
Auto				
Maintenance & Fuel	$16	$16	$16	$16
Toll Fare (Toll1/Toll2)	$10/$16	$10/$16	$10/$16	$10/$16
Monthly Toll Pass	$100	$100	$100	$100
Modal Alternative				
Fare	N/A	$20	$70	$50
Monthly Fare Pass	N/A	$200	$500	$400
B. Travel and Wait Times (min)[2]				
Auto				
Vancouver - Squamish	55	55	55	55
Vancouver - Whistler	100	100	100	100
Modal Alternative				
Vancouver - Squamish	N/A	85	80	80
Vancouver - Whistler	N/A	155	125	165

1. Out-of-pocket costs exclude access costs to bus, rail or ferry terminals.
2. Travel time on the upgraded toll highway would result in a 15 min savings between Vancouver-Squamish and 20 min savings between Vancouver-Whistler. Travel time for bus, rail and ferry includes a 20 min terminal wait time. A 15 min transfer time is included for the passenger ferry/rail option for trips between Vancouver-Whistler.

2.2.1 Option 1 – Expanded Toll Highway

The expanded toll highway option would include four laning of the Sea-to-Sky highway between Horseshoe Bay and Squamish and three laning from Squamish to Whistler. Safety improvements and spot improvements recommended by ICBC would also be implemented. In addition, an electronic toll system will be installed to eliminate the need for toll stations. Tolls would be tallied and the user billed at the end of each month. Note that the highway upgrades and toll configuration are included in all options.

Out-of-pocket travel costs for auto include 13 cents/km for maintenance and fuel and the price of the toll. For the first toll concept, one-way auto costs between Vancouver-Squamish and Squamish-Whistler would be $13 ($8 operating and $5 toll). Between Vancouver-Whistler auto costs would be $26 ($16 operating and $10 toll). For the second toll concept these costs would increase to $16 and $32, respectively. A monthly toll pass would be available for frequent users at a price of $100 per month for either toll concept.

Travel time between Vancouver-Squamish would be 55 minutes and 100 minutes for the trip to Whistler. Note that upgrades to the highway would result in auto travel timesavings of 15 minutes between Vancouver and Squamish and 20 minutes between Vancouver and Whistler over current peak period travel times (based on information from the Reid Crowther Study[2]).

2.2.2 Option 2 – Expanded Toll Highway with Scheduled Bus

This option includes the highway improvements and toll concepts identified in Option 1, plus the introduction of a scheduled highway coach bus. The highway coach service would provide seven scheduled runs per day (both directions) between Downtown Vancouver and Whistler with stops in Squamish and along the corridor.

One-way bus fares between Vancouver-Squamish and Vancouver-Whistler would be $10 and $20, respectively. A monthly bus pass would be available for $100 for trips between Vancouver-Squamish and Squamish-Whistler. Between Vancouver-Whistler, a monthly pass would be available for $200.

Bus travel times are based on the current scheduled times, but include travel timesavings resulting from the upgraded highway. Total travel time (including an average 20 minute terminal wait time) between Vancouver-Squamish and Vancouver-Whistler would be 85 and 155 minutes, respectively. Note that the bus terminal would be located in downtown Vancouver.

2.2.3 Option 3 – Expanded Toll Highway with High Speed Rail

This option includes the highway improvements and toll concepts identified in Option 1 and a new high-speed rail service. This option is based on one of

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[2] Reid Crowther & Partners Ltd., Multi-Modal Corridor Transportation Study: Horseshoe Bay to Highway 97, BC Ministry of Transportation and Highways, March 2001.

the options examined for the "Higher Speed Passenger Rail - Vancouver to Whistler"[3] Study. The service would begin at the Pacific Central Station and cross over to Horseshoe Bay via a new underground tunnel and then use existing rail infrastructure to travel to Whistler. In addition, support facilities such as rock fall protection, crossing protection, maintenance facilities and stations would also be made available or upgraded. New tilting body passenger trains would be used to achieve higher corridor speeds. This service would also provide seven scheduled trips per day in each direction.

A one-way fare between Vancouver-Squamish and Vancouver-Whistler would be $35 and $70, respectively. A monthly rail pass would be available for $350 for trips between Vancouver-Squamish and Squamish-Whistler. Between Vancouver-Whistler, a monthly pass would be available for $500. Fare levels were established on the assumption that the services should operate on a commercial basis.

Travel times for high-speed rail are based on information from the CANAC report. Total travel time (including an average 20 minute terminal wait time) between Vancouver and Squamish and Vancouver and Whistler would be 80 and 125 minutes, respectively.

2.2.4 Option 4 – Expanded Toll Highway with Ferry/Train

This option includes the highway improvements and toll concepts identified in Option 1 and a new 220 passenger-only ferry service between Waterfront Station and the Nexen site in Squamish. A connecting rail service similar to the current Cariboo Prospector would operate between the Squamish terminal and Whistler. The passenger-only ferry concept is based on information in the "Marine Options Greater Vancouver to Squamish - Feasibility Study"[4]. This service would also provide seven scheduled trips per day in each direction.

A one-way fare between Vancouver-Squamish and Vancouver-Whistler would be $25 and $50, respectively. A monthly ferry/rail pass would be available for $250 for trips between Vancouver-Squamish and Squamish-Whistler. Between Vancouver-Whistler, a monthly pass would cost $400. Fare levels were established on the assumption that the services should operate on a commercial basis.

Travel times for the passenger-only ferry/rail service are based on information from the Seymour report. Total travel time (including an average 20 minute terminal wait time) between Vancouver and Squamish would be 80 minutes. Travellers continuing on to Whistler would experience a 15-minute transfer time, resulting in a total travel time of 165 minutes.

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[3] CANAC Inc. and D.A. Sutherland, Higher Speed Passenger Rail – Vancouver to Whistler, November 2001

[4] Jonathan Seymour & Associates Inc., Marine Options Greater Vancouver to Squamish – Feasibility Study, BC Ministry of Transportation, December 2001

3. Stated Preference Survey

To provide input for the modal diversion analysis, a stated preference survey was conducted among residents of the Sea-to-Sky Corridor and the GVRD. The purpose of the research was to collect:

i) recent travel behaviour; and

ii) anticipated usage of the transportation alternatives under the two toll concepts.

3.1 Survey Design

Basic Approach

This survey is a follow-up to the Sea-to-Sky Corridor Travel Demand Study conducted in the fall of 2001. As such, the basic methodology has been replicated. A telephone survey was completed among a random cross-section of study area residents to identify the target market of Sea-to-Sky Corridor travellers. The basic approach to the concept testing was patterned after that used in the previous study.

Target Market

As in the Fall 2001 survey, the target market consisted of persons 16 years of age and over who reside in the Sea-to-Sky Corridor or the GVRD and who used the Sea-to-Sky Corridor in the past year.

Definition of Study Area

The study region for this survey has been defined to include the residents of seven sub-areas as follows:

A. Sea to Sky Corridor Residents
   1. Whistler
   2. Squamish
   3. Other corridor residents from Lion's Bay to Pemberton

B. Greater Vancouver Regional District Residents
   4. GVRD North Shore (West Vancouver including Horseshoe Bay, North Vancouver)
   5. GVRD City of Vancouver/Burnaby/New Westminster
   6. GVRD north of Fraser (Port Moody, Coquitlam, Port Coquitlam, Maple Ridge, Pitt Meadows, Haney)
   7. GVRD south of Fraser (Richmond, Delta, Ladner, Tsawwassen, White Rock, Surrey, Langley, Fort Langley)

Current Travel Behaviour

The questionnaire was designed to collect travel behaviour in the most recent winter and summer seasons. Respondents who used the Sea-to-Sky Corridor in the past year were first asked about recent travel patterns, including

frequency in each of the last summer and last winter season and various characteristics of the most recent trip in each season (origin-destination, purpose, mode, party size and length of trip).

Toll-price Testing Approach

To test the two proposed toll concepts under review, a split-sample approach was used. Since the toll road concept was identical for both options with the only differential being toll cost, this method ensured that the pricing options were tested independently.

Two random replicated samples were completed within each geographic area, dividing Sea-to-Sky users into two independent sample cells. Furthermore, weighting adjustments were made at the data analysis stage to match the two sample cells on key demographics.

Concept Testing

Descriptions of "possible transportation choices under consideration" were presented to Sea-to-Sky users. After hearing a description of the new highway scenario (under a single toll option), respondents were presented with alternative mode choices one at a time—scheduled highway coach service, high-speed rail service and a passenger-only ferry service to Squamish plus rail connection to Whistler. Anticipated usage in summer and in winter was collected for each of these modal options, assuming that the toll highway also existed.

3.2 Survey Implementation

In total, 1,073 random telephone interviews were conducted across the study region, resulting in 603 completions with past year travellers along the Sea-to-Sky Corridor.

Sample Selection

The sample frame was a Telus database of published, residential numbers (the most up-to-date source of changed and newly listed telephone numbers in B.C.). The frame was stratified into the seven geographic zones, noted above. Random samples of households were selected in each of the defined sub-areas of the study region, with replicates drawn for each sample cell.

A disproportionate sampling plan was devised in order to boost the sample sizes among residents of the Corridor communities, who are heavy users of the Corridor but represent a small proportion of the total target market population (predominantly GVRD residents). At the data analysis stage, the sample was weighted back into correct proportion by region.

Within each household, the individual to be interviewed was chosen by a randomized technique (next birthday method). To ensure proper gender balance, alternate selection of males and females was employed Probability of selection information was collected to later convert the sample of households into a sample of individuals, projectable to the area population.

Up to five calls were made in an attempt to obtain a completed interview with the selected household/individual, thereby reducing the effect of any possible non-response bias.

Data Collection

All interviews were completed April 18 to May 1, 2002 from McIntyre & Mustel's CATI (Computer Assisted Telephone Interviewing) centre, where trained telephone field staff are continuously supervised and monitored. Fieldwork was conducted weekday evenings and Saturday and Sunday daytimes. Note that interviews were distributed across the seven days of the week as evenly as possible.

Questionnaire/Pre-testing

The questionnaire used in this study was developed in consultation with the client. A pre-test was conducted prior to the start of the fieldwork. The pre-test was monitored by representatives of TSi and McIntyre & Mustel Research. No modifications were required to the questionnaire, but the pre-test did assist in developing procedural improvements.

Weighting Procedures

Weighting adjustments have been applied to bring the resulting sample into correct proportion on key demographic variables. The following procedures were used to match the most recently available census data for the study region/study population.

The 1996 Statistics Canada census data was used as a basis for preparing 2001 population projections. These census projections reflect an "aging" of the most recently available census distributions (i.e., adjusting age category counts by the number of years since the last census collection); these projections have also factored in the overall effects of immigration and mortality on the population totals.

First, the probability of selection at the household level was applied, converting the sample of households into a sample of individuals 16 years of age and over. Next adjustments were applied to match the sample to 2001 census projections for the study area based on age within gender and bringing the seven geographic zones into correct relative proportion to each other. Weights were applied to the cross-section sample (consisting of Sea-to-Sky users and non-users, therefore, representing the entire population 16 years of age and over in the study area). The resulting sample of Sea-to-Sky users and non-users is thereby representative of the study region.

Exhibit 3.1 shows the distribution of actual and weighted interviews for completed calls and qualifying calls (i.e. users of the STS corridor in the past season).

Exhibit 3.1 – Distribution of Interviews

	Completed Calls			Qualifying Calls (STS Users)		
	Actual	Actual	Weighted	Actual	Actual	Weighted
	1,073	1,073	1,556,011	603	603	643,924
	#	%	%	#	%	%
Gender						
Male	539	50.2%	48.7%	323	53.6%	53.2%
Female	534	49.8%	51.3%	280	46.4%	46.8%
Age						
16 – 34	364	34.0%	36.3%	216	35.8%	42.2%
35 – 54	453	42.2%	38.0%	265	44.0%	39.5%
55 and over	247	23.0%	24.6%	121	20.1%	18.0%
Refused	9	0.9%	1.1%	1	0.2%	0.2%
Sub-Area						
STS Corridor	274	25.5%	1.2%	263	43.6%	2.7%
Whistler	82	7.6%	0.4%	80	13.3%	1.0%
Squamish	150	14.0%	0.7%	141	23.4%	1.5%
Other Corridor	42	3.9%	0.1%	42	7.0%	0.2%
GVRD	799	74.5%	98.8%	340	56.4%	97.2%
North Shore	129	12.0%	9.0%	80	13.3%	13.4%
Van/Burn/New West	315	29.4%	42.5%	140	23.2%	44.6%
Rest N. of Fraser	114	10.6%	12.3%	42	7.0%	11.5%
Rest S. of Fraser	241	22.5%	35.0%	78	12.9%	27.7%

Cell weighting was applied to match the two toll pricing cells on age within gender for each of Sea-to-Sky Corridor residents and for GVRD residents who use the Corridor. **Exhibit 3.2** shows the distribution of actual and weighted interviews by cell.

Exhibit 3.2 – Distribution of Interviews by Toll Cell

	Cell 1 ($5/$10 toll)			Cell 2 ($8/$16 toll)		
	Actual	Actual	Weighted	Actual	Actual	Weighted
	303	303	643,921	300	300	643,923
	#	%	%	#	%	%
Gender						
Male	163	53.8%	53.2%	160	53.3%	53.2%
Female	140	46.2%	46.8%	140	46.4%	46.8%
Age						
16 – 34	113	37.3%	42.3%	103	34.3%	42.3%
35 – 54	129	42.5%	39.5%	136	45.3%	39.6%
55 and over	60	19.9%	18.1%	61	20.4%	18.1%
Refused	1	0.3%	0.2%	-	0.0%	0.0%
Sub-Area						
STS Corridor	133	43.9%	2.7%	130	43.3%	2.7%
GVRD	170	56.1%	97.3%	170	56.6%	97.3%

4. Modal Diversion Analysis

Annual demand estimates for the three modal alternatives under the two toll concepts were developed based on individuals stated intent to use. This demand is made up of trips that are diverted from the automobile or induced by the new alternative (e.g., would not otherwise be made). This information is then used to estimate modal diversion rates for each option, which represent the ratio of modal demand to the original auto person demand (without the toll highway).

The following sections provide a description of the survey validation process and present the modal diversion analysis.

4.1 Annual Corridor Travel Demand

As described in **Section 3**, the stated preference survey provides information on respondents current travel behaviour and anticipated usage of the modal alternatives. The first step involved the validation of this information with previous estimates of corridor travel demand. Information on current travel behaviour was expanded to annual estimates and found to be comparable to the previous Sea-to-Sky study. **Exhibit 4.1** provides a comparison of the annual auto person travel demand by season for corridor and GVRD residents.

Exhibit 4.1 – Annual STS Inter-City Travel (Auto Persons)

	Current Study		
	Summer	Winter	Total
Trip Purpose	(May-Oct 2001)	(Nov-Apr 2002)	
Commuting/Business	1,317,500	1,301,500	2,619,000
Recreation/Social	3,458,400	3,385,800	6,844,200
Shopping/Personal Business	229,400	298,000	527,400
Total	5,005,300	4,985,300	9,990,600

4.2 Modal Diversion Rates

The stated preference survey presented three modal alternatives that could be available in conjunction with the toll highway (e.g., scheduled bus, high speed rail, passenger ferry/rail). Respondents were asked how often they would use the service and whether or not these trips would be in addition or diverted from their automobile trips. This information provided a basis for establishing base year demand for the alternatives. Additionally, the percentage of trips diverted from the automobile or induced by the new service can be estimated.

4.2.1 Demand for Scheduled Bus Service

Based on information from the stated preference survey, demand estimates for the scheduled bus service were determined for each toll concept by trip purpose. Note that non-residents were not surveyed, but demand has been estimated based on information from the previous Sea-to-Sky Corridor Travel Demand Study. **Exhibit 4.2** shows low and high annual demand estimates for the scheduled bus service.

Exhibit 4.2 – Annual Scheduled Bus Demand Estimates

	Annual Bus Demand			
	Toll 1		Toll 2	
Trip Purpose	Low	High	Low	High
Commuting/Business	95,800	103,800	174,300	178,200
Recreation/Social	295,900	340,400	279,400	344,500
Shopping/Per Business	11,800	13,800	14,300	18,300
Non-Residents[1]	100,000	100,000	100,000	100,000
Total	503,500	558,000	568,000	641,000

1. Non-resident demand estimated from previous STS Corridor Travel Demand Study

Low and high estimates are based on different weightings applied to the likelihood of use response (e.g., definitely, probably, etc.). For toll concept 1, annual demand is estimated between 503,500 and 558,000. The majority of this demand is for recreational or vacation purposes and some commuting/business travel. Note that the commuting/business demand includes a mix of corridor commuters and infrequent business travellers. For toll concept 2, annual demand increases to between 568,000 and 641,000. Under this toll level, more infrequent business travellers showed an interest in the service (commuting levels were similar as the price of the monthly bus pass was fixed).

Further analysis of the data showed that 88 percent of the demand would be diverted from the automobile, while 12 percent would be induced (i.e. not made if the service did not exist). These percentages were consistent for both toll concepts.

Note that the current Greyhound and Perimeter scheduled service carries approximately 300,000 passengers per year along the Sea-to-Sky corridor. Charter services account for approximately 400,000 passengers per year. Therefore, the demand estimates for the new scheduled bus service appear to be within reason, given the introduction of highway tolls.

4.2.2 Demand for High Speed Rail

Exhibit 4.3 shows low and high annual demand estimates for the high-speed rail service. Non-resident demand for high-speed rail is based on information from the previous STS Corridor Travel Demand Study, but has been adjusted to reflect the higher speed and connection to downtown Vancouver.

Exhibit 4.3 – Annual High Speed Rail Demand Estimates

	Annual High Speed Rail Demand			
	Toll 1		Toll 2	
Trip Purpose	Low	High	Low	High
Commuting/Business	57,100	78,900	91,800	106,100
Recreation/Social	344,900	384,500	378,400	406,600
Shopping/Per Business	18,000	18,600	20,800	21,200
Non-Residents[1]	125,000	125,000	125,000	125,000
Total	545,000	607,000	616,000	658,900

1. Non-resident demand estimated from previous STS Corridor Travel Demand Study

For toll concept 1, annual demand is estimated between 545,000 and 607,100. The majority of this demand is for recreational or vacation use. For toll concept 2, annual demand increases to between 616,000 and 658,900. Some corridor commuters and infrequent business travellers showed an interest in the service, but this demand was likely constrained by the high fare levels.

Analysis of the data also showed that 89 percent of the demand would be diverted from the automobile, while 11 percent would be induced (i.e. not made if the service did not exist). These percentages were consistent for both toll concepts and are very similar to the bus demand estimates.

Demand estimates from the previous study indicated that an improved rail service could attract between 100,000 and 150,000 annual trips for the current year. This service had similar fare levels, but lower frequencies (e.g. 3 northbound, 3 southbound per day) a much slower travel speed (e.g., 160 minutes to Whistler vs. 125 minutes) and the terminal was located at North Vancouver Quay. The current survey would seem to indicate that high speed rail from downtown Vancouver could generate approximately five times more demand than the earlier rail concepts. Note however, that the high-speed rail demand estimates are about one-third of the current West Coast Express ridership. Furthermore, the capital cost of high-speed rail is well in excess of $1 billion.

4.2.3 *Demand for Passenger Ferry/Rail*

Exhibit 4.4 shows low and high annual demand estimates for the passenger ferry/rail option. Non-resident demand for this service is based on information from the previous STS Corridor Travel Demand Study.

Exhibit 4.4 – Annual Passenger Ferry/Rail Demand Estimates

	Annual Passenger Ferry/Rail Demand			
	Toll 1		Toll 2	
Trip Purpose	Low	High	Low	High
Commuting/Business	-	40,700	48,300	48,700
Recreation/Social	220,000	228,200	277,500	325,100
Shopping/Per Business	-	1,200	10,200	11,200
Non-Residents[1]	100,000	100,000	100,000	100,000
Total	320,000	370,100	436,000	485,000

1. Non-resident demand estimated from previous STS Corridor Travel Demand Study

For toll concept 1, annual demand is estimated between 320,000 and 370,100. As with the other alternatives, the majority of this demand is for recreational or vacation use. For toll concept 2, annual demand increases to between 436,000 and 485,000.

Analysis of the data also showed that 90 percent of the demand would be diverted from the automobile, while 10 percent would be induced (i.e. not made if the service did not exist). These percentages were consistent for both toll concepts and are very similar for all modal options.

Demand estimates from the previous study indicated that a ferry/bus concept could attract between 300,000 and 390,000 annual trips for the current year. This previous estimate is very close to the ferry estimate for toll concept 1.

4.2.4 *Calculation of Modal Diversion Rates*

Based on the demand estimates and information on diverted and induced trips, modal diversion rates have been developed for each option. **Exhibit 4.5** provides a summary of the annual demand for each option and the percentage diverted from the current auto person demand level.

Low and high modal diversion rates are shown for each option and range between 2.8 and 5.8 percent of the current auto person demand. For example, under toll concept 1 with the scheduled bus service, it is estimated that 4.4 to 4.9 percent of the current auto person demand would divert to the bus service.

Exhibit 4.5 – Annual Demand for Alternative Modes and Diversion Rates

Option	Annual Bus, Rail or Ferry Demand				Annual Auto Person Trips	% Diversion to Alt. Mode	
	Low	High	% Induced	% Diverted	Base	Low	High
1a Toll Hwy (Toll 1)					11,330,500		
1b Toll Hwy (Toll 2)					11,330,500		
2a Toll Hwy w Bus (Toll 1)	503,500	558,000	12%	88%	11,330,500	4.4%	4.9%
2b Toll Hwy w Bus (Toll 2)	568,000	641,000	12%	88%	11,330,500	5.0%	5.7%
3a Toll Hwy w Rail (Toll 1)	545,000	607,000	11%	89%	11,330,500	4.8%	5.4%
3b Toll Hwy w Rail (Toll 2)	616,000	658,900	11%	89%	11,330,500	5.4%	5.8%
4a Toll Hwy w Ferry/Rail (Toll 1)	320,000	370,100	10%	90%	11,330,500	2.8%	3.3%
4b Toll Hwy w Ferry/Rail (Toll 2)	436,000	485,000	10%	90%	11,330,500	3.8%	4.3%

4.3 Summary of Modal Diversion Analysis Results

This analysis provides information on demand estimates and diversion rates for three modal alternatives under the two toll concepts. Note that the demand estimates are for the current year.

Scheduled Bus Demand and Diversion Rates

Demand for the scheduled bus service is estimated between 503,500 and 641,000 (increasing with the higher toll level). The majority of these trips are being made for recreation and vacation purposes, with some commuter and business users. These estimates are higher than current scheduled bus ridership (e.g., 300,000), and could be attributed to the highway toll and the fact that many people are unfamiliar with existing bus services. The majority of the bus demand would be diverted from the automobile, resulting in bus diversion rates between 4.4 and 5.7 percent. These diversion rates represent the percentage of current auto person demand that would use the service.

High Speed Rail Demand and Diversion Rates

Demand for high-speed rail is estimated between 545,000 and 658,900 (increasing with the higher toll level). The majority of these trips are being made for recreation and vacation purposes. These estimates are approximately five times higher than the demand estimated for the rail options in the Sea-to-Sky Corridor Travel Demand Study (e.g., 100,000 to 150,000). The rail options in the earlier study were less frequent, significantly slower and did not connect to downtown Vancouver. Note however, these demand estimates are approximately one-third of West Coast Express and the capital cost of this option is well in excess of $1 billion. Again, the majority of the rail demand would be diverted from the automobile, resulting in diversion rates between 4.8 and 5.8 percent.

Passenger Ferry/Rail Demand and Diversion Rates

Demand for the passenger ferry/rail option is estimated between 320,000 and 485,000 (increasing with the higher toll level). The majority of these trips are being made for recreation and vacation purposes. The demand estimate at the lower toll level is similar to the demand estimated for the ferry/bus option in the Sea-to-Sky Corridor Travel Demand Study (e.g., 300,000 to 390,000). As with the other options, the majority of ferry/rail demand would be diverted from the automobile, resulting in diversion rates between 2.8 and 4.3 percent.

Application of Diversion Rates

Care should be taken when applying these diversion rates to other toll concepts. The diversion rate can vary significantly by toll level, type of service and trip purpose. All of these factors should be closely analyzed when estimating new diversion rates. Additional research is recommended if the toll level or service characteristics are significantly different from the toll concepts adopted in the stated preference survey.

Although the demand for these modal alternatives was only tested relative to a toll highway, it would appear that the toll has a positive impact on ridership. However, based on the stated modal diversion rates, these services would capture a relatively small percentage of the current auto person demand.

5. Conclusions

The primary objective of this study was to estimate the proportion of Sea-to-Sky auto travellers that would divert to alternate modes with the introduction of highway tolls on an upgraded highway. Two toll concepts were examined to determine the potential modal diversions.

- **Toll 1** $5 Vancouver – Squamish, Squamish – Whistler
  $10 Vancouver – Whistler
  $100 Monthly pass for frequent users with unlimited usage
- **Toll 2** $8 Vancouver – Squamish, Squamish – Whistler
  $16 Vancouver – Whistler
  $100 Monthly pass for frequent users with unlimited usage

The toll concepts were tested against three modal alternatives including a scheduled coach bus service, high-speed rail and a passenger-only ferry/rail service between Vancouver, Squamish and Whistler. These options have been identified in previous studies and provide different levels of service (e.g., travel times, fares, etc.) and also range dramatically in terms of capital and operating costs.

A stated preference survey with Sea-to-Sky Corridor and GVRD residents was conducted to assess current demand levels and anticipated usage of the transportation alternatives under each toll concept. Annual auto passenger corridor demand was estimated at approximately 10 million trips. Non-residents auto passenger demand was estimated at 1.3 million from the previous Sea-to-Sky Corridor Travel Demand Study. Hence, total annual auto demand is approximately 11.3 million.

Demand estimates and diversion rates were developed for the three modal alternatives under the two toll concepts.

Demand for the modal alternatives ranged from approximately 300,000 to 650,000 passengers per year, with high-speed rail attracting the highest ridership. Note however, that the rail demand estimate is approximately one-third of the West Coast Express ridership and the capital cost of this option is well in excess of $1 billion. Modal diversion rates ranged from 2.8 to 5.8 percent of the current auto person demand.

Although the demand for these modal alternatives was only tested relative to a toll highway, the toll would appear to have a positive impact on ridership (based on comparisons with previous modal estimates). However, based on the stated diversion rates, these services would capture a relatively small percentage of the suppressed auto demand. Based on preliminary cost information, it would appear that the scheduled bus service and passenger ferry/rail option could be viable services with or without a toll highway. The high-speed rail service would require significant passenger subsidies and does not appear to capture significantly higher demand than the other two relatively low cost modal alternatives.